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FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

SEP 10 1997

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of)	
)	
Federal-State Joint Board on)	CC Docket 96-45
Universal Service)	
)	
Forward-Looking Mechanism)	
for High Cost Support for)	CC Docket 97-160
Non-Rural LECs.)	

JOINT REPLY COMMENTS OF BELL SOUTH CORPORATION, BELL SOUTH
TELECOMMUNICATIONS, INC., US WEST, INC., AND SPRINT LOCAL TELEPHONE
COMPANIES TO FURTHER NOTICE OF PROPOSED RULEMAKING
SECTIONS III.C.1

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SUMMARY

In these Reply Comments, BellSouth, US WEST and Sprint Local Telephone Companies (“Joint Sponsors”) respond to various comments arguing in favor of the immediate implementation of geocoding. The Joint Sponsors note that, perhaps more so than other commenters, as ILECs operating in 31 states, they are aware that even the best geocoding is often extremely inaccurate and *always* incomplete. More importantly, using this flawed data as the foundation for cost estimation, as proposed by the Hatfield Sponsors, virtually guarantees significant errors will reside in all phases of the cost estimation that the Hatfield Model produces.

The Joint Sponsors also provide, in some detail, an outline of the problems with the Hatfield Model clustering algorithm. Among other problems, the Hatfield cluster results in the inability to locate up to 56% of rural households. Because customer location is necessary to determine (1) the *number of clusters* in any given wire center; (2) the *area* of these clusters; (3) the *distance* from these clusters to outliers; and (4) the proper plant *engineering* required to serve these customers, it remains to be seen how this algorithm can be adopted.

The “strand mapping” concept proposed by the Hatfield modelers is equally suspect. To date, the Hatfield sponsors have not provided (1) an algorithm for this mapping; (2) an explanation of how strands are linked to clusters; or (3) an indication of the engineering required to serve customers located in strands.

The problems inherent in each of these proposals has been solved in the BCPM’s enhanced customer location algorithm. These Reply Comments provide detail of the enhanced BCPM’s integration of CB data and road network data which permits the location of customers in rural areas more precisely than the limited geocode approach proposed by Hatfield sponsors

Finally, the Joint Sponsors disagree with those commenters who would suggest that high-cost support should be “targeted” at the wire center level based on wire center average costs. One of the many advantages of the enhanced BCPM methodology is the ability to aggregate costs to more granular levels. This facilitates targeting support to a more easily administered level such as CBGs, zones within the wire center, or even zip codes.

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SECTIONS III.C.1

Bell South, US West and the Sprint Local Telephone Companies (hereinafter
“Joint Sponsors”) respectfully submit their replies to comments filed on September 2,
1997 in the above-captioned matter.

I. THE CURRENT STATE OF GEOCODING DOES NOT ALLOW FOR ITS
ADOPTION AT THIS TIME.

Earlier in this proceeding, the Joint Sponsors examined the possibility of using
geocoded customer locations as the basis for locating customers. What we found was
that, in densely populated urban areas, this was a simple task since customer address
can be easily and readily mapped to an exact location. However, in rural areas,
geocoding becomes more difficult as the customer’s “address” is often a rural route, a
post office box number, or some community mail box location. Indeed, in their
September 3, 1997 ex-parte presentation, the Hatfield Model sponsors stated that fully
56% of rural households had not been located using their techniques which included,
among other things, using mailing lists.

This inability to locate the majority of rural households is a serious shortcoming, because these are the very households that need explicit universal service support to access affordable telephone service. The inability to locate these customers creates two problems. First, by accurately locating and counting urban (low cost) customers, while not properly locating many rural (high cost) customers, the overall cost of constructing the network will be understated, as would be the average cost per customer. Second, to the degree that the count of customers in rural areas is understated, the total size of the explicit fund would be further understated. Such an outcome would not allow the Commission to carry out the Congressional mandate that the new explicit fund be “sufficient”.¹

Several parties suggest partial solutions to this problem. The Hatfield sponsors’ suggestion (which is addressed in more detail below) would have the Commission ignore the situation. GTE suggests that some form of sampling of rural areas be conducted using “... commercially available software to geocode a random sample of locations in a serving area and extrapolate this information to a larger area”.² There are a multitude of flaws in such an approach. First, commercial geocoding software will suffer from all of the limitations described above. More importantly, however, as stated by the Joint Sponsors in their September 3, 1997 comments³ and reinforced by RUS⁴, rural areas are unique and diverse. Consequently, the value of sampling would appear suspect and would contradict the Commission’s stated objective of targeting support to the customers who need it the most.

Various commenters applaud the evolving capabilities of LECs to geocode the customer base.⁵ The Joint Sponsors are well aware of the informational benefits that

¹ Communications Act of 1934 as amended by the Telecommunications Act of 1996 at Section 254(e).

² GTE at 11.

³ Joint Sponsors’ Comments filed September 2, 1997, at 16.

⁴ RUS at 1.

⁵ See TDS at 12, Ameritech at 6, RUS at 2 and 4, Alliant at 2.

come from geocoding, and the potential usefulness of this type of information. In fact, as mentioned above, the Joint Sponsors initially considered geocoding as an approach to customer location and subsequently rejected this method. The reason is quite simple -as ILECs operating in 31 states, the Joint Sponsors are aware that even the best geocoding is often extremely inaccurate and *always* incomplete. More importantly, using this flawed data as the foundation for cost estimation, as proposed by the Hatfield Sponsors, virtually guarantees significant errors will reside in all phases of the cost estimation that the Hatfield Model produces.

The Joint Sponsors' propose that universal geocoding be implemented by 2001 to improve the future usefulness of the geocoding approach. In support of this proposal, the Joint Sponsors submit that, while certain companies have already geocoded some of their customers, others have not yet begun this process. Should the Commission require all LECs desiring to participate in the new explicit universal service fund to geocode all of their customer locations by no later than 2001, companies will have sufficient time to complete this task. More importantly, this additional time will allow the proxy models and fund to function on the basis of precise customer locations at the time when rural LECs are scheduled to come under a proxy-based fund.

II. THE CUSTOMER LOCATION PROCESS RECOMMENDED BY THE HATFIELD SPONSORS HAS YET TO BE DEVELOPED, AND IS NOT WELL SUITED TO THE DETERMINATION OF HIGH COST SUPPORT.

In their September 2, 1997 comments, and in their ex-parte presentation on September 3, 1997, AT&T and MCI describe a theoretical process which has yet to be reduced to an analytical algorithm - and thus is not available for inspection and testing. In their ex-parte presentation, AT&T and MCI offered mock-ups of how their "clustering" algorithm might work, and stated that "real" data for several "illustrative"

wire centers would not be available until September 24, 1997. They further stated that it was not their intent to analyze even one entire state using their methodology until the Commission has adopted its proposal as the means for locating customers. Given the paucity of AT&T and MCI's showings to date, it is difficult for the Joint Sponsors to meaningfully comment on the proposal offered by AT&T and MCI. Nonetheless, we will attempt to do so.

The Hatfield Sponsors' proposed new approach for locating customers is an attempt to geocode, or identify by latitude and longitude, all customer locations and thereby create "clusters" of customer locations to serve as engineering areas. The purported benefit of this approach is to "provide important information on cluster characteristics" including the number of clusters in a wire center, their location, their size and the distance between customers in clusters⁶. The Hatfield sponsors tout this new approach as an improvement over their "window pane" clustering technique that was utilized in previous versions of the Hatfield Model (through version 4.0).

In their recent ex-parte presentation, the Hatfield Sponsors documented their lack of success in the geocoding process - in addition to the 56% of rural households not geocoded, 30% of households overall are not covered by their geocoding data. It is important to understand how this will impact each phase of the Hatfield Model's estimation.

According to the Hatfield Sponsors, the "clusters" are created using location data as an input. An optimization routine uses this input data and minimizes the area of clusters and distance of outliers (customers located outside of clusters) from the clusters. Depending on density and distance characteristics, the optimization routine will "group together" customers that reside within a certain critical distance of each other. The actual distance that is chosen as the critical distance within a wire center

“will vary as a result of differing population densities.”⁷ The shortcoming of this approach is obvious: *If 56% of the customers cannot be located, how is it possible to know how far they are from one another?* Moreover, the Hatfield cluster will necessarily be irregularly shaped polygons, which no other party will be able to replicate. The Hatfield Model sponsors would need to provide digital mapping files of these polygons to allow others to verify their counts of households and business lines.

The Hatfield sponsors claim that their new clustering algorithm considers the distance between customers within a cluster. One of the most significant criticisms of the Hatfield 4.0 clustering algorithm is the placement of customers within the cluster on 3-acre contiguous lots. As described in Attachment B to the Joint Sponsors’ September 2nd filing, this approach grossly underestimates the actual dispersion of customers within the cluster. It is imperative that the Hatfield sponsors’ new clustering algorithm is closely analyzed to ensure that it is an adequate representation of the actual dispersion of customers within a cluster.

The Hatfield sponsors also state that in those 56% of rural cases where they cannot geocode, it is possible to map a customer location to a specific census block (CB). The Joint Sponsors have seriously question this assertion. The Joint Sponsors have purchased location data from the same source as Hatfield - PNR & Associates⁸- and PNR has indicated that, in many cases, customer locations can only be mapped to census block *groups* and sometimes census *tracts*..

The Joint Sponsors also question the method to be used to situate customers at a specific location within these CBs, CBGs, or census tracts. When asked their approach for assigning a location to customers who have no addresses and cannot be assigned a

⁶ AT&T and MCI at 8.

⁷ Hatfield Sponsors handout presented at September 3rd workshop, Washington DC.

⁸ Joint Sponsors agree that PNR is the best source for this type of information; however in this case the problem is that the information simply does not exist.

latitude/longitude measure, the Hatfield sponsors indicated that this part of the process was still in development. Since customer location determines (1) the *number of clusters* in any given wire center; (2) the *area* of these clusters; (3) the *distance* from these clusters to outliers; and (4) the proper plant *engineering* required to serve these customers, it is hoped that this crucial element (or, more precisely, the lack of this element) will not be overlooked by those judging the proxy models.

If and only if the exact address is recognized by the geocoding software will the household be geocoded to an exact latitude and longitude at the point on the street. Where the exact address cannot be pinpointed, the software will assign the household to the latitude and longitude of the centroid of the nearest postal zip code area. However, while 9-digit zip codes, which allow for precise geocoding, are relatively commonplace for urban areas, they rarely exist for rural areas. The U.S. postal mailing address for rural areas typically consists of a rural route delivery number or a post office box number. Although the 7-digit zip code is the next highest level of geocoding precision, few rural areas are assigned 7-digit zip codes. The next level of accuracy is the 5-digit zip code. If Hatfield Sponsors geocode to the 5-digit zip code for those rural customers for whom they lack precise location data, it will result in substantially less precision in locating customers than an approach which assigns customers to CBs. There are typically more than 10 CBs located in an area encompassed by a 5-digit zip code. Indeed, almost without exception, the area encompassed by a 5-digit zip code is greater than the area encompassed by the CBGs associated with that zip code. Thus, in those cases, the new approach proposed by the Hatfield sponsors would be less precise than the approach adopted in Hatfield 4.0 and its predecessors. The Hatfield sponsors' new approach for geocoding customers would err by an order of magnitude for customers assigned according to a 5-digit zip code relative to an approach that locates customers according to CBs. Importantly, the

enhanced BCPM's approach places customers within a CB along the road network, increasing considerably the degree of precision in locating customers in rural areas.

The Joint Sponsors have long known that when address information does not exist, geocoding is not possible. And as the Commission is aware, any clustering done with flawed information produces flawed results. For this reason, the BCPM utilizes customers assigned to census blocks and distributed below the CB level along the road system. This information is not driven by a subjective, private algorithm but is instead based on publicly available data.

III. STRAND MAPPING

The Hatfield sponsor's proposed concept of "strand mapping" is highly questionable. Strand mapping is the term used by the Hatfield sponsors for their approach to locating and linking customers who reside outside of clusters. To date, the Hatfield sponsors have not provided (1) an algorithm for this mapping; (2) an explanation of how strands are linked to clusters; or (3) an indication of the engineering required to serve customers located in strands. In fact, the Hatfield sponsors themselves question the usefulness and feasibility of strand mapping. At page 8 of its comments, AT&T notes that "[T]he Hatfield model developers are continuing to explore the feasibility and desirability of this approach. Whether or not actual strand mapping proves feasible and desirable, it is important to recognize that accurately locating customers produces the greatest benefits (inaccuracy) in sparsely populated areas." The Joint Sponsors agree with this declaration, and thus are doubly concerned about the Hatfield sponsors' proposal to base engineering on customer locations that cannot be verified or even identified.

IV. AT&T and MCI's CRITICISM OF THE ENHANCED BCPM METHODOLOGY IS ILL-FOUNDED AND ERRONEOUS.

The Joint Sponsors consider it critical to address several misconceptions created by AT&T and MCI regarding the enhanced BCPM (though we must note that, at times it is unclear whether AT&T's and MCI's criticisms are targeted toward BCPM1.1 or the forthcoming, enhanced BCPM. However, because the relevant analysis pertains to those comments directed at the enhanced BCPM, our response focuses exclusively on those comments).

AT&T and MCI describe the grid cells generated in the enhanced BCPM as "arbitrary constructs". They claim that CBGs and CBs are not arbitrary constructs because they "reflect to a certain degree natural geographic features and population clusters."⁹ Furthermore, it is alleged that "the information contained in CB or CBG boundaries will be jettisoned through the adoption of grid cells." AT&T's and MCI's assessments indicate a fundamental lack of understanding of the grid process utilized in the enhanced BCPM.

The grid cells are not established on a capricious basis. To the contrary, the grid cells are based on integrating increased granular customer location data with an efficient forward-looking network design that is engineered to serve clusters of customers, as well as outlying customers. Indeed, the enhanced BCPM does not use any data at the CBG level because of the increased precision obtained using CB data and road network data.

As described in our September 2nd comments, Census housing data and PNR business data is collected at the CB level. By using microgrids¹⁰, which are typically smaller than CBs in rural areas, this data is apportioned throughout a given CB in a

⁹ AT&T and MCI's Reply Comments, at 4.

¹⁰ Recall that microgrids are 1/200th of a degree latitude and longitude or approximately 1,500 by 1,700 feet.

simple, but fundamentally sound manner. It is apportioned based on the proportion of the road network that traverses that microgrid within a CB. Since customers are typically located along the road network, this approach increases the precision of locating customers within a CB.

The second phase of the grid process entails aggregating the microgrids into the ultimate grid size. The ultimate grid size is rooted in sound engineering practices. The grid process aggregates microgrids to the level at which a Carrier Serving Area (CSA) is required.¹¹ A CSA is engineered to accommodate a maximum of 1,200 lines.¹² A maximum of four Distribution Areas (DAs) are associated with a CSA.

RUS stated in its comments at page 4 “Road locations in rural areas govern the actual placement of plant, but in the models have little influence over the actual estimation of feeder and distribution plant.” The Joint Sponsors agree with RUS that the road locations heavily influence the placement of telephone plant. We do not, however, agree with RUS’ assertion that the enhanced BCPM does not use this data. The DLC is placed at the road centroid of the ultimate grid. The ultimate grid is quadded around the CSA. No DA is placed within an empty quadrant. Given that housing and business line data is apportioned based on the road network, those quadrants that do not have any roads are empty. The DA feeder/distribution interface within a non-empty quadrant is sized based on the area along a 500-foot buffer along the roads within that quadrant. The DA is centered about the road centroid of the quadrant. Information garnered using the road network facilitates placement of plant in locations where customers are likely to reside. This aggregation process essentially clusters customers in a manner that is consistent with engineering outside plant. This

¹¹ It is possible that no CSA is placed in the ultimate grid if the ultimate grid is sufficiently close to the central office that no digital loop carrier is necessary.

¹² In the Joint Sponsors’ September 2nd comments, we mistakenly stated that the number of customers served in a CSA ranged from 1,000 to 1,600 lines.

same aggregation process permits building plant to serve customers who reside outside of clusters or towns in an efficient manner.

The aggregation process permits ultimate grid sizes from $1/200^{\text{th}}$ of a degree up to $1/25^{\text{th}}$ of a degree latitude and longitude, although some grids may exceed this maximum size due to re-aggregation of partial grids located on the perimeter of a wire center. The largest grid size permitted is equivalent to approximately 12,000 feet to 14,000 feet per side (some grids at the perimeter can exceed this size by approximately 2,000 to 3,000 feet on a side). This maximum grid size is used to comport with engineering constraints that the maximum copper distribution run should be on average no longer than 12,000 feet, while any particular customer length should not exceed 18,000 feet. Although, at first blush, it may appear that the maximum grid size could be 18,000 feet by 18,000 feet, the constraint on engineering copper loops even with courser gauge cable can be complied with only if the CSA were placed in the center of the ultimate grid. However, as indicated earlier, the CSA is placed at the road centroid of the ultimate quad to best reflect where customers are likely to reside on average, given the road network. It is highly unlikely that the road centroid is located precisely at the center of the ultimate grid. This, if ultimate grid sizes of 18,000 feet by 18,000 feet are permitted, the constraint on the maximum copper loop length is likely to be violated. And, as stated earlier, the engineering constraint is to limit the average maximum loop length to 12, 000 feet.

Clearly CB information is retained and not jettisoned as alleged by AT&T and MCI since the CB provides the foundation for aggregating housing and business line data within the ultimate grid.

Given the limitations of the existing database to provide precise geocode information regarding customers in rural areas, neither the Hatfield sponsors nor any other party can adequately geocode those customers for whom it is most critical to

provide universal service support. The enhanced BCPM's integration of CB data and road network data permits locating customers in rural areas more precisely than the limited geocode approach proposed by Hatfield sponsors and developers.

V. **CALLS BY SOME PARTIES TO "TARGET" HIGH COST SUPPORT TO THE WIRE CENTER WILL NOT ACCOMPLISH THE COMMISSION'S GOALS FOR UNIVERSAL SERVICE SUPPORT, AND WILL CAUSE MARKET DISLOCATIONS.**

Both Bell Atlantic¹³ and WorldCom¹⁴ suggest that high-cost support should be "targeted" at the wire center level based on wire center average costs. It is understandable that these companies would suggest such an approach because its end result would be a smaller fund¹⁵. The problem with this approach is that even in the wire centers with the highest average cost, there are customers who are very inexpensive to serve. Customers along main streets cost less to serve, while customers in remote locations require a great deal more expense. Basing support to all customers in the wire center on average cost poses the following problems:

- Carriers will be incented to market their services most heavily to those customers located along main streets where the fund support received may greatly exceed the cost of serving the customer.
- Any funds removed from the system to support lower cost customers diminishes the ability to cover the costs of serving high cost customers due to the impacts of averaging.
- The incentive of carriers to construct new facilities to serve high cost portions of the wire center will be all but eliminated, since the costs of this

¹³ Bell Atlantic at 1

¹⁴ WorldCom at 1

¹⁵ Bell Atlantic serves high-density East Coast states and does not need significant explicit support to keep rates affordable. WorldCom has not stated that it intends to construct local loop facilities in high-cost areas.

- construction would never be recovered by support determined by average costs.

It should be made clear, however, that while the Joint Sponsors advocate the computation of costs at the grid cell level, we do not advocate the targeting of support to this level. Indeed as stated in our earlier comments, one of the advantages of the enhanced BCPM methodology is the ability to aggregate costs to more granular levels. This facilitates targeting support to a more easily administered level such as CBGs, zones within the wire center, or even zip codes.

Respectfully submitted,

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CERTIFICATE OF SERVICE

I, Melinda L. Mills, hereby certify that I have on this 10th day of September, 1997, served via U.S. First Class Mail, postage prepaid, or Hand Delivery, a copy of the foregoing "Joint Reply Comments of BellSouth Corporation, BellSouth Telecommunications, Inc., US West, Inc., and Sprint Local Telephone Companies to Further Notice of Proposed Rulemaking Sections III.C.1" in the Matter of Federal-State Joint Board on Universal Service, CC Docket No. 96-45, and Forward-Looking Mechanism for High Cost Support for Non-Rural LECs, CC Docket No. 97-160, filed this date with the Acting Secretary, Federal Communications Commission, to the persons on the attached service list.



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